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# Research to Reduce the Burden on Participants Tested for Olfactory Sensitivity in Community Health Checkups: Proposal to Change the Odour Stick From 12 types to 6 types

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**Abstract**

For many years, olfactory sensitivity tests have been conducted at community health checkups using a simple olfactory sensitivity test kit (Odour Stick: manufactured by Daiichi Pharmaceutical Co., Ltd.). In this study explored whether it might be possible to assess olfactory sensitivity decline using a smaller number of odors rather than the 12 odors. We report the results of tests conducted on university students and elderly individuals. The simple odor test was conducted using the conventional 12 odors, and the results were compared between olfactory judgments using the 12 odors and those using a reduced number of odors. The subjects were university students and elderly people. As a result, olfactory test results were obtained for 101 university students and 109 elderly people, and judgments were made on 12 types (India ink, timber, perfume, menthol, mandarin oranges, curry, home gas, rose, cypress, sweaty socks, condensed milk, and fried garlic) and the five odor combinations (each of which selected six out of 12) were statistically processed. The results showed that the combination of three main scents (home gas, sweaty socks, and fried garlic) and three difficult-to-identify scents (timber, mandarin oranges, and roses) was the most consistent with the results of the 12-sensory test of odor. No statistically significant differences were found. We believe that in future resident health checkups, judgments will be possible based on the results of olfactory tests on these 6 types.

**Keyword:** Simple Odor Test Kit, 12 Odors, 6 Odors, Olfactory sensitivity test, Odor sticks, community health checkup

## I. Introduction

For many years, we have been conducting olfactory tests using a simple olfactory test kit (Odor Stick: Daiichi Pharmaceutical Co., Ltd.) at community health checkups. The test kit contains 12 odor sticks. While the 12 odors familiar to Japanese people at the time this simple olfactory test kit was developed (India ink, timber, perfume, menthol, mandarin oranges, curry, home gas,

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rose, cypress, sweaty socks, condensed milk, and fried garlic) are now less common in today's Japanese lives. Participants who took the test commented that the house had not on tatami mats, the bathtub was made of plastic (it used to be made of cypress), and perfumes now come in a variety of scents, making it difficult to identify the specific scent. In addition, more than 200 people participate in the resident health checkups each day, and it is necessary to complete the tests for all participants in the shortest possible time. If we can reduce the number of odor test from 12 to 6 and still get the same results as before, we can reduce the burden on participants. We conducted this study with the belief that simplification of olfactory testing is necessary to further increase the number of resident participation in future health checkups.

## 2. Method

An olfactory test was conducted using a simple olfactory test kit: (The Odor Stick Identification Test: OSIT-J, Smelly Stick, manufactured by Daiichi Pharmaceutical Industry Co., Ltd.) [1,2,3] using 12 different odors (India ink, timber, perfume, menthol, mandarin oranges, curry, home gas, rose, cypress, sweaty socks, condensed milk, and fried garlic) according to the conventional procedure [4], and the results were obtained.

### *2.1 Participants*

The subjects were 109 elderly people (mean age 71.3 years: 60-92 years: female) who participated in a health class and 101 university students (mean age 20.0 years: 18-22 years: 37 males and 64 females) who participated in a university festival (see Tables 1and 2).

**Table 1. Age distribution of female participant in the 2024 health class**

| Age | 60s | 70s | 80s | 90s |
|---|---|---|---|---|
| Number of people (n=109) | 41 | 62 | 5 | 1 |

**Table 2. Age distribution of participants in the 2024 University Festival**

| Age | 18 years old | 19 years old | 20 years old | 21 years old | 22 years old |
|---|---|---|---|---|---|
| Male (n=37) | 10 | 8 | 6 | 8 | 5 |
| Female (n=64) | 6 | 0 | 37 | 17 | 4 |
| Total (n=101) | 16 | 8 | 43 | 25 | 9 |

### *2.2. How to choose 6 smells from 12 smells*

Five patterns of 6 types of odor tests selection methods were considered.
① The top six odors with the highest correct answer rate in the odor test.

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② The three main types of odors (sweaty socks, home gas, fried garlic) and the three types of odors that we often come into contact with in our daily lives (curry, perfume, menthol).
③ The three main types of odors (sweaty socks, home gas, fried garlic) and the three odor types with poor accuracy.
④ The top two correct answers smell, middle two, and bottom two odor test results.
⑤ In accordance with T&T olfactometer test, a precision test, the following odors were selected: sweaty socks (sweaty odor), roses (floral odor), condensed milk (sweet odor), fried garlic (burnt odor), home gas, and one more odor (depend on the results).

### *2.3. Statistical Processing*

The results of the 12 types of olfactory tests and the results of the six types of odor tests (5 patterns) selected this time were statistically processed using the Wilcoxon test.
From the results of statistical processing, patterns in which there was no difference between the results of the 12 types of olfactory tests and the results of the selected 6 types of olfactory tests were selected and examined.

## 3. Results

The correct answer rates for the 12 types of olfactory tests are shown below.

### *3.1. Olfactory test accuracy rate results*

The results for the elderly are shown in Table 3, and the results for the university students are shown in Table 4. The results of an odor test conducted on elderly people showed that the odors that were easily to identify were in the order curry, menthol, sweaty socks/condensed milk, home gas, fried garlic, perfume/cypress, India ink, timber, and roses/mandarin orange (see Table 3).

**Table 3. Olfactory Test Results in the 2024 Health Class (109 Elderly People)**

| Olfactory type | India ink | Timber | Perfume | Memthol | Mandarin orange | Curry |
|---|---|---|---|---|---|---|
| Correct answer | 58 | 54 | 70 | 83 | 53 | 90 |
| Incorrect answer | 51 | 55 | 39 | 26 | 56 | 19 |
| Correct answer rate | 53.21 | 49.54 | 64.22 | 76.15 | 48.62 | 82.57 |
| **Olfactory type** | **Home Gas** | **Rose** | **Cypress** | **Sweaty socks** | **Ccondensed milk** | **Fried garlic** |
| Correct answer | 78 | 53 | 70 | 80 | 80 | 76 |
| Incorrect answer | 31 | 56 | 39 | 29 | 29 | 33 |
| Correct answer rate | 71.56 | 48.62 | 64.22 | 73.39 | 73.39 | 69.72 |

According to the results of an odor test conducted among university students, the easily identifiable odors were in the order sweaty socks, menthol, fried garlic, rose, curry, perfume, cypress, mandarin oranges, lumber, home gas, India ink, and condensed milk (see Table 4).

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**Table 4. Olfactory Test Results of the 2024 University Festival (101 University Students)**

| Olfactory type | India ink | Timber | Perfume | Memthol | Mandarin orange | Curry |
|---|---|---|---|---|---|---|
| Correct answer | 76 | 79 | 85 | 97 | 80 | 89 |
| Incorrect answer | 25 | 22 | 16 | 4 | 21 | 12 |
| Correct answer rate | 75.25 | 78.22 | 84.16 | 96.04 | 79.21 | 88.12 |
| **Olfactory type** | **Home Gas** | **Rose** | **Cypress** | **Sweaty socks** | **Ccondensed milk** | **Fried garlic** |
| Correct answer | 73 | 90 | 82 | 99 | 66 | 95 |
| Incorrect answer | 28 | 11 | 19 | 2 | 35 | 6 |
| Correct answer rate | 72.28 | 89.11 | 81.19 | 98.02 | 65.35 | 94.06 |

### *3.2. Results of choosing 6 odors from 12 odors*

When comparing the results of the olfactory test between elderly people and university students, it was found that elderly people had difficulty distinguishing between odors (lower correct answer rate). Therefore, we considered five patterns for selecting six odors and the correct answer rate for each odor in the olfactory test results of elderly people. (SEE Table 5).

**Table 5. Selection of six odors by elderly people, taking into account the accuracy rate of the 12 odors.**

| Olfactory type | Curry | Memthol | Sweaty socks | Ccondensed milk | Home Gas | Fried garlic | Perfume | Cypress | India ink | Timber | Mandarin orange | Rose |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correct answer rate (%) | 82.57 | 76.15 | 73.39 | 73.39 | 71.56 | 69.72 | 64.22 | 64.22 | 53.21 | 49.54 | 48.62 | 48.62 |
| Six types of odors ① | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | |
| Six types of odors② | ○ | ○ | ○ | | ○ | ○ | ○ | | | | | |
| Six types of odors③ | | | ○ | | ○ | ○ | | | | ○ | ○ | ○ |
| Six types of odors④ | ○ | ○ | | | | ○ | ○ | | | | ○ | ○ |
| Six types of odors⑤ | | ○ | ○ | ○ | ○ | ○ | | | | | | ○ |

In addition, because the corret answer rat for the 12 odors was higher for university students than for elderly people, the selection of the six odors was based on the odor selection of eldery people. We set three main smells that we wanted people to be aware of: household gas ( Gas explosion prevention), sweaty socks(Foood poisoning prevention), and fried garlic (Fire prevention).

### *3.3. Three classification criteria and classification result*

Using Table 5. As a reference, the olfactory test results were classified into normal range, observation required, and consultation required based on Table 6. The elderly were classified as shown in Table 7, and the university students were classified as shown in Table 8.

**Table 6. Odor evaluation criteria established in this study**

| | Normal range | Observation required | Consultation required |
|---|---|---|---|
| Tweleve tipes of odors | 6 or more | 5 to 3 | 2 to 0 |
| Six types of odors | 3 or more | 2 to 1 | 0 |

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**Table 7. Comparison of 12 odor test results with 6 other odor test results in elderly people**

| Elderly people (n=109) | Normal range | Observation required | Consultation required |
|---|---|---|---|
| Tweleve tipes of odors | 84 | 22 | 3 |
| Six types of odors ① | 99 | 8 | 2 |
| Six types of odors② | 99 | 8 | 2 |
| Six types of odors③ | 84 | 21 | 3 |
| Six types of odors④ | 89 | 17 | 3 |
| Six types of odors⑤ | 92 | 14 | 3 |

**Table 8. Comparison of 12 odor test results with 6 other odor test results in University students**

| University students (n-101) | Normal range | Observation required | Consultation required |
|---|---|---|---|
| Tweleve tipes of odors | 99 | 2 | 0 |
| Six types of odors ① | 99 | 2 | 0 |
| Six types of odors② | 101 | 0 | 0 |
| Six types of odors③ | 98 | 3 | 0 |
| Six types of odors④ | 100 | 1 | 0 |
| Six types of odors⑤ | 101 | 0 | 0 |

### *3.4. Statistical processing results*

The results of 12 different olfactory tests were compared with the results of six different olfactory tests in five patterns. The results for the elderly are shown in Table 9, and the results for the university students are shown in Table 10. For the university students, there was no statistically significant difference between the results of the 12 types of olfactory tests and the results of the 6 types of olfactory tests in the 5 patterns. However, in the elderly, there was statistically significant difference between patterns ① and ②, and pattern ③ (The three main types of odors :sweaty socks, home gas, fried garlic and the three odor types with poor accuracy: timber, mandarin orange, rose) did not show any statistically significant difference and was closer to the results of the 12 types of simple olfactory tests (P=0.820).

**Table 9. Stastistical comparison results of differences n olfactory test evaluations in the elderly**

**(Tweleve tipes of odors and Six tipes of odors ①、②、③、④、⑤)**

| | Tweleve tipes of odors | | Six types of odors ① | | Six types of odors ② | | Six types of odors ③ | | Six types of odors ④ | | Six types of odors ⑤ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average | Standard deviation | Average | Standard deviation | Average | Standard deviation | Average | Standard deviation | Average | Standard deviation | Average | Standard deviation |
| Evaluation | 1.257 | 0.498 | 1.128 | 0.411 | 1.11 | 0.365 | 1.266 | 0.521 | 1.211 | 0.473 | 1.183 | 0.455 |
| Wilcoxon test | | | P=0.001** | | P=0.0001** | | P=0.820 | | P=0.0.221 | | P=0.098 | |

＊：P＜0.05、＊＊：P＜0.01

Statistical calculations were performed with the normal range of data as1, obsevation required as 2, and consultation required as 3.

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Table 10. Stastistical comparison results of differences n olfactory test evaluations in the unibersity studens
(Tweleve tipes of odors and Six tipes of odors ①、②、③、④、⑤)

| | Tweleve tipes of odors | | Six types of odors ① | | Six types of odors ② | | Six types of odors ③ | | Six types of odors ④ | | Six types of odors ⑤ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average | Standard deviation | Average | Standard deviation | Average | Standard deviation | Average | Standard deviation | Average | Standard deviation | Average | Standard deviation |
| Evaluation | 1.119 | 0.402 | 1.119 | 0.402 | 1.101 | 0.384 | 1.128 | 0.411 | 1.110 | 0.393 | 1.101 | 0.384 |
| Wilcoxon test | | | P=1.00 | | P=0.180 | | P=0.593 | | P=0.317 | | P=0.180 | |

＊：P＜0.05、＊＊：P＜0.01

Statistical calculations were performed with the normal range of data as1, obsevation required as 2, and consultation required as 3.

## 4. Discussion

Since 20 years, we performed olfactometry in Yakumo-cyo inhabitants examination. [1-5]. The Odor Stick Identification Test (OSIT-J) was used to assess odor perception. This test possesses high reliability and validity [6]. The OSIT-J includes 12 different odorants to be identified. As odor perception is closely related to culture and life experiences, the Japanese version was employed [7, 8]. The basic procedure resembles that of the San Diego Odor Identification Test [9]. Olfaction start to decline in humans around the age of 50-60 years, with 40% of the elderly experiencing a noticeable decline[10]. Olfaction is also responsible for enrichment and psychological stimulation in our everyday lives, such as with the scents and smells of foods and flowers [11]. In an already aged society, healthy olfaction is a necessary part of creating a safe and fertile living environment and for improving an individual's quality of life. Our level of sensory recognition of odor is created by the circumstances of our everyday lives [12].

Of the 12 odors, the elderly had a correct answer rate of 70% or more for five odors (curry, menthol, sweaty socks, condensed milk, home gas), and a correct answer rate of 60% or more for three odors (fried garlic, perfume, cypress).

Of the 12 odors, the university students had a correct answer rate of 90% or more for three odors (sweaty socks, menthol, and fried garlic), a correct answer rate of 80% or more for four odors (rose, curry, perfume, and cypress), a correct answer rate of 70% or more for four odors (mandarin orange, , India ink, timber and home gas), and a correct answer rate of 60% or more for one odor (condensed milk).

The highest correct answer of smells include important smells such as the burnt smell that prevents fires (fried garlic), smelling out rotten things (sweaty socks), and preventing gas explosions (home gas). Furthermore, they also include the smell of curry, which is often served as a meal in daily life, the smell of perfume used in cosmetics and detergents, and the smell of menthol, which is used in medicinal patches. As these are smells that are more closely related to modern life and are used in daily life, we believe that these Smells are easy to understand and choose.

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In Pattern ①, the top six odors selected for the elderly's test were curry, menthol, sweaty socks, condensed milk, home gas, and fried garlic. It was found that by rating the data as normal (being able to detect 3 or more odors), requiring observation (being able to detect 2 to1 odors), and requiring consultation (being able to detect zero odors), the results showed a statistically significant difference (P=0.001**) from the results of 12 types of olfactory tests.

In Pattern ②, for odors with a correct answer rate of 60% or more, the top six odors common to both elderly people and university students were selected, resulting in curry, menthol, sweaty socks, home gas, fried garlic, and perfume. The odor data using the 12 types of odors was then reviewed using these six odors. The results showed a statistically significant difference (P=0.0001**) from the results of 12 types of olfactory tests.

In Pattern ③, three types of odors that are important for living safely (home gas, sweaty socks, and fried garlic) and the three odors that were least noticeable to the elderly (timber, mandarin oranges, and roses) were selected and compared with the test results for 12 types of odors. The results showed no statistically significant difference (P=0.820) from the results of 12 types of olfactory tests.

In Pattern ④, the results of the olfactory tests were compared with the results of 12 types of olfactory tests for the top two odors of the elderly (curry, menthol), the middle odors (home gad, fried garlic), and the bottom two odors (mandarin oranges, rose). The results showed no statistically significant difference (P=0.221) from the results of 12 types of olfactory tests.

In Pattern ⑤, according to the T&T olfactometer test used for detailed examinations in the otolaryngology field, six types of odors were selected: condensed milk as sweet odor, rose as floral odor, fried garlic as burnt odor, sweaty socks as sweaty odor. Since fecal odor was not included in the 12 types of olfactory tests, we decided to use a different odor. We plus menthol and curry, which are odors commonly used in daily life. There 6 odors compared with the results of the 12 types of olfactory test. The results showed no statistically significant difference (P=0.098) from the results of 12 types of olfactory tests.

The above results showed that pattern ③ did not show any statistically significant difference and was closer to the results of the 12 types of simple olfactory tests (P=0.820).

Based on the above, we would like to conduct tests for only six types of odors (timber, mandarin orange, rose, sweaty socks, home gas, and fried garlic) in the future in the prefectures and cities where residents live, in order to reduce the burden on participants and increase the number of people taking the health checkups.

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Furthermore, since the results of this study showed that the smell of curry was the easiest to detect, it may be a good idea to add a final test to see if participants who had difficulty detecting the smell in pattern ③ can detect the smell of curry. We would like to continue this research and consider this further in the future.

## Conclusion

In resident health checkups, olfactory testing with 12 types of odors can be burdensome and time-consuming for some participants, so it is desirable to test with fewer odors so that more participants can participate. The six odors selected this time (timber, mandarin orange, rose, sweaty socks, home gas, and fried garlic) are odors that are closely related to modern life and used in daily life, making them easy to understand and select. The three-point evaluation system—three or more correct answers indicate normal, 2-1 odors indicate need for observation, and zero odors indicate need for consultation—provides a close match between the evaluation of the 12-type odor test and the evaluation of the six-type odor test. Therefore, we believe that using the six selected odors in the future will contribute to shortening the time required for resident health checkups and increasing the number of participants.

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